

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Attorney Docket No.: 004438.0005

In re Application of:

KLIMASAUŠAKAS ET AL.

Serial No. 09/165,854

Filed: 2 OCTOBER 1998

For: HYBRID LINEAR NEURAL
NETWORK PROCESS CONTROL

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Examiner: JONES, H.

Art Unit: 2763

PRELIMINARLY AMENDMENT

Assistant Commissioner of Patents
Washington, D.C. 20231

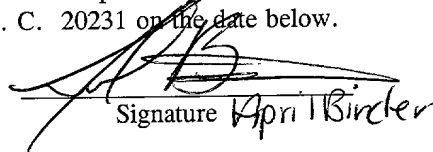
Sir:

This Preliminary Amendment is submitted in response to the Examiner's Final Office Action dated September 27, 2000, having a shortened statutory period set to expire December 27, 2001.

CERTIFICATE OF MAILING
37 CFR 1.8(a)

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3/27/01
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Signature April Bircher

IN THE CLAIMS

Please amend the claims as follows:

1. (Amended) An apparatus for modelling a process, said process includes one or more disturbance variables as process input conditions, one or more corresponding manipulated variables as process control conditions, and one or more corresponding controlled variables process output conditions, said apparatus comprising:

a primary analyzer for generating a set of outputs using a first set of disturbance variables, manipulated variables, and controlled variables as inputs to a curve-fitting algorithm;

an error correction analyzer, coupled to said primary analyzer, for generating a set of error correction variables using said set of outputs from said primary analyzer and a second set of disturbance variables, manipulated variables, and controlled variables as inputs; and

an adder, coupled to said primary analyzer and said error correction analyzer, for generating a set of control variables for modelling said process by summing said set of outputs from said primary analyzer and said set of error correction variables from said error correction analyzer.

2. (Amended) The apparatus of Claim 1, wherein said primary analyzer samples said first set of disturbance variables, manipulated variables, and controlled variables continuously.

3. (Amended) The apparatus of Claim 1, wherein said primary analyzer samples said first set of disturbance variables, manipulated variables, and controlled variables in predetermined delay periods.

1 4. (Amended) The apparatus of Claim 3, wherein said predetermined delay periods are
2 determined by an adaptive process.

1 5. (Amended) The apparatus of Claim 3, wherein said predetermined delay periods are user
2 selectable.

Please cancel Claim 6.

1 7. (Amended) The apparatus of Claim 1, wherein said disturbance variables and said
2 manipulated variables are latent variables.

1 8. (Amended) The apparatus of Claim 1, wherein said curve-fitting algorithm is based on a
2 linear model.

1 9. (unchanged) The apparatus of Claim 8, wherein said linear model is a Partial Least
2 Squares (PLS) model.

1 10. (Amended) The apparatus of Claim 9, wherein said apparatus further includes a filter
2 coupled to said primary analyzer for providing a filtered vector as an output.

1 11. (unchanged) The apparatus of claim 10, wherein said filter is adaptive.

1 12. (unchanged) The apparatus of claim 10, wherein said filter is a Kalman filter adapted to
2 receive said controlled variables.

Please cancel Claim 13.

1 14. (unchanged) The apparatus of claim 9, wherein said error correction analyzer is a neural
2 network.

Please cancel Claim 15.

1 16. (Amended) The apparatus of claim 14, wherein said apparatus further includes a filter
2 coupled to an input of said primary analyzer.

1 17. (Amended) The apparatus of claim 9, wherein said error correction analyzer is based on
2 a neural network partial least squares model.

1 18. (Amended) The apparatus of claim 1, wherein said apparatus further includes:

2 a distributed control system coupled to the output of said adder; and

3 a run-time delay and variable selector coupled to the output of said distributed
4 control system.

1 19. (Amended) The apparatus of claim 18, wherein said run-time delay and variable selector
2 are adapted to receive delay and variable settings, wherein said primary analyzer and said error
3 correction analyzer are adapted to receive model parameters, said apparatus further includes:

4 a data repository for storing historical values of said disturbance variables, said
5 manipulated variables and said controlled variables;

6 a development delay and variable selector coupled to said data repository for
7 selecting and time-shifting one or more of said disturbance variables, said manipulated
8 variables and said controlled variables, said development delay and variable selector
9 generating said delay and variable settings; and

10 a hybrid development analyzer coupled to said development delay and variable
11 selector, said hybrid development analyzer generating said model parameters.

1 20. (unchanged) The apparatus of claim 18, wherein said hybrid development analyzer further
2 comprises:

3 a development primary analyzer coupled to said data repository, said development
4 primary analyzer adapted to sample a development input vector spanning one or more of
5 said disturbance variables and manipulated variables, said development primary analyzer
6 adapted to sample one or more controlled variables, said development primary analyzer
7 generating an output based on said input vector;

8 a subtractor coupled to said data repository and to said development primary
9 analyzer, said subtractor adapted to receive one or more controlled variables from said
10 data repository, said subtractor generating a primary model error output;

11 a development error correction analyzer coupled to said data repository and said
12 development primary analyzer error output, said development error correction analyzer
13 adapted to sample said development input vector, said development error correction
14 analyzer estimating a residual between said development primary analyzer output and said
15 controlled variables; and

16 an adder coupled to the output of said development primary analyzer and said
17 development error correction analyzer, said adder summing the output of said primary
18 and error correction analyzers to estimate said controlled variables.

Please cancel Claims 21-39.

Please add Claim 40.

1 40. (New) A program storage device having a computer readable program code embodied
2 therein for modelling a process, said process includes one or more disturbance variables as
3 process input conditions, one or more corresponding manipulated variables as process control

conditions, and one or more corresponding controlled variables process output conditions, said
program storage device comprising:

program code means for generating a set of outputs using a first set of disturbance
variables, manipulated variables, and controlled variables as inputs to a curve-fitting
algorithm;

program code means for generating a set of error correction variables using said
set of outputs from said primary analyzer and a second set of disturbance variables,
manipulated variables, and controlled variables as inputs; and

program code means for generating a set of control variables for modelling said
process by summing said set of outputs from said primary analyzer and said set of error
correction variables from said error correction analyzer.

REMARKS

Applicants have amended the claims to further characterize the claimed invention over the cited prior art.

No extension of time or fee is believed to be necessary because a three-month extension of time had been requested and a \$890.00 check for the extension of time had been submitted along with the previous amendment. However, in the event that any extension of time or fee is required for the prosecution of this application, please charge it against the firm Deposit Account No. 50-0259.

Respectfully submitted,



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1. (Amended) An apparatus for modelling a process, said process [having] includes one or more disturbance variables as process input conditions, one or more corresponding manipulated variables as process control conditions, and one or more corresponding controlled variables process output conditions, said apparatus comprising:

a [data derived] primary analyzer [adapted to sample an input vector spanning one or more of said] for generating a set of outputs using a first set of disturbance variables, [and] manipulated variables, and controlled variables as inputs to a curve-fitting algorithm [said data derived primary analyzer generating an output based on said input vector];

an error correction analyzer, coupled to said primary analyzer, for generating a set of error correction variables using said set of outputs from said primary analyzer and a second set of disturbance variables, manipulated variables, and controlled variables as inputs [adapted to sample said input vector, said error correction analyzer estimating a residual between said data derived primary analyzer output and said controlled variables]; and

an adder, coupled to [the output of] said [data derived] primary analyzer and said error correction analyzer, for generating a set of control variables for modelling said process by summing said set of outputs from said primary analyzer and said set of error correction variables from said error correction analyzer [said adder summing the output of said primary and error correction analyzers to estimate said controlled variables].

2. (Amended) The apparatus of Claim 1, wherein said [data derived] primary analyzer [and said error correction analyzer] samples said [input vector] first set of disturbance variables, manipulated variables, and controlled variables continuously.

3. (Amended) The apparatus of Claim 1, wherein said [data derived] primary analyzer [and said error correction analyzer] samples said [input vector] first set of disturbance variables, manipulated variables, and controlled variables in [using] predetermined delay periods.

4. (Amended) The apparatus of Claim 3, wherein said predetermined delay periods [is] are determined by an adaptive process.

5. (Amended) The apparatus of Claim 3, wherein said predetermined delay periods [is] are user selectable.

6. cancelled.

7. (Amended) The apparatus of Claim 1, wherein said disturbance variables and said manipulated variables are latent variables.

8. (Amended) The apparatus of Claim 1, wherein said [data derived primary analyzer] curve-fitting algorithm is based on a linear model.

1 9. (unchanged) The apparatus of Claim 8, wherein said linear model is a Partial Least
2 Squares (PLS) model.

1 10. (Amended) The apparatus of claim 9, wherein said apparatus further includes [comprising]
2 a filter coupled to [the output of] said [data derived] primary analyzer[, said filter receiving said
3 output vector and] for providing a filtered vector as an output.

1 11. (unchanged) The apparatus of claim 10, wherein said filter is adaptive.

1 12. (unchanged) The apparatus of claim 10, wherein said filter is a Kalman filter adapted to
2 receive said controlled variables.

13. cancelled.

1 14. (unchanged) The apparatus of claim 9, wherein said error correction analyzer is a neural
2 network.

15. cancelled.

1 16. (Amended) The apparatus of claim 14, wherein said apparatus further includes
2 [comprising] a filter coupled to [the] an input of said [data derived] primary analyzer[, said filter
3 receiving said input vector and providing a filtered vector for capturing the dynamics of the
4 process to the input of said neural network].

1 17. (Amended) The apparatus of claim 9, wherein said error correction analyzer is based on
2 a neural network partial least squares model.

1 18. (Amended) The apparatus of claim 1, wherein said apparatus further includes
2 [comprising]:

3 a distributed control system coupled to the output of said adder; and

4 a run-time delay and variable selector coupled to the output of said distributed
5 control system[, said run-time delay and variable selector generating said input vector].

1 19. (Amended) The apparatus of claim 18, wherein said run-time delay and variable selector
2 are adapted to receive delay and variable settings, wherein said [data derived] primary analyzer
3 and said error correction analyzer are adapted to receive model parameters, said apparatus further
4 includes [comprising]:

5 a data repository for storing historical values of said disturbance variables, said
6 manipulated variables and said controlled variables;

7 a development delay and variable selector coupled to said data repository for

8 selecting and time-shifting one or more of said disturbance variables, said manipulated
9 variables and said controlled variables, said development delay and variable selector
10 generating said delay and variable settings; and

11 a hybrid development analyzer coupled to said development delay and variable
12 selector, said hybrid development analyzer generating said model parameters.

1 20. (unchanged) The apparatus of claim 18, wherein said hybrid development analyzer further
2 comprises:

3 a development primary analyzer coupled to said data repository, said development
4 primary analyzer adapted to sample a development input vector spanning one or more of
5 said disturbance variables and manipulated variables, said development primary analyzer
6 adapted to sample one or more controlled variables, said development primary analyzer
7 generating an output based on said input vector;

8 a subtractor coupled to said data repository and to said development primary
9 analyzer, said subtractor adapted to receive one or more controlled variables from said
10 data repository, said subtractor generating a primary model error output;

11 a development error correction analyzer coupled to said data repository and said
12 development primary analyzer error output, said development error correction analyzer
13 adapted to sample said development input vector, said development error correction
14 analyzer estimating a residual between said development primary analyzer output and said
15 controlled variables; and

16 an adder coupled to the output of said development primary analyzer and said
17 development error correction analyzer, said adder summing the output of said primary
18 and error correction analyzers to estimate said controlled variables.

21-39. cancelled

1 40. (New) A program storage device having a computer readable program code embodied
2 therein for modelling a process, said process includes one or more disturbance variables as
3 process input conditions, one or more corresponding manipulated variables as process control
4 conditions, and one or more corresponding controlled variables process output conditions, said
5 program storage device comprising:

6 program code means for generating a set of outputs using a first set of disturbance
7 variables, manipulated variables, and controlled variables as inputs to a curve-fitting
8 algorithm;

9 program code means for generating a set of error correction variables using said
10 set of outputs from said primary analyzer and a second set of disturbance variables,

11 manipulated variables, and controlled variables as inputs; and

12 program code means for generating a set of control variables for modelling said
13 process by summing said set of outputs from said primary analyzer and said set of error
14 correction variables from said error correction analyzer.

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11 an adder coupled to the output of said data derived empirical primary analyzer and
12 said error correction analyzer, said adder summing the output of said primary and error
13 correction analyzers to estimate said controlled variables.

1 41. (NEW) A method for modeling a process having one or more disturbance
2 variables as process input conditions, one or more corresponding manipulated variables as
3 process control conditions, and one or more corresponding controlled variables as process
4 output conditions, said method comprising the steps of:

5 (a) picking one or more selected variables from said disturbance variables and
6 said manipulated variables;

7 (b) providing said selected variables to a data derived empirical primary
8 analyzer and an error correction analyzer;

9 (c) generating a primary output from said selected variables using said data
10 derived empirical primary analyzer;

11 (d) generating a predicted error output from said selected variables using said
12 error correction analyzer; and

13 (e) summing the output of said primary and error correction analyzers.

42. (NEW) A program storage device having a computer readable program
code embodied therein for modeling a process, said process having one or more
disturbance variables as process input conditions, one or more corresponding manipulated
variables as process control conditions, and one or more corresponding controlled
variables as process output conditions, said program storage device comprising:

a data derived empirical primary analyzing code adapted to sample an input vector
spanning one or more of said disturbance variables and manipulated variables, said data
derived empirical primary analyzing code generating an output based on said input vector;

an error correction analyzing code adapted to sample said input vector, said error
correction analyzing code estimating a residual between said data derived empirical
primary analyzing code output and said controlled variables; and

an adder code coupled to the output of said data derived empirical primary
analyzing code and said error correction analyzing code, said adder code summing the
output of said primary and error correction analyzing code to estimate said controlled
variables.

REMARKS

This is a continuation application of a case to be allowed providing new claims. Applicants submit claims 1-5, 7-12, 14-39, and new claims 40-42 to be allowed. If there are any questions or comments, please contact Albert B. Kimball, Jr. at (713) 850-0909.

Respectfully submitted,



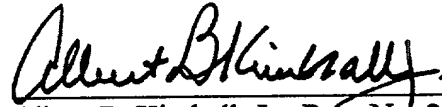
Albert B. Kimball, Jr., Reg. No. 25,689

Date: October 2, 1998

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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231 on October 2, 1998.



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